

## LOW-CARBOHYDRATE SWEETENER

## BACKGROUND OF THE INVENTION

This invention pertains to a low carbohydrate, low glycemic index, cane sugar- free sweetener comprising Lo Han Quo Extract and Sucratose Liquid or Powder for use in an improved tasting ice cream , or as a sweetener for baked goods, candy, and beverages..

Prior art conventional ice creams are sweetened with about 7 to 29 wt. % of natural sugars i.e. cane sugar . They also contain about 10 wt. % or more of fats. Further, the total carbohydrate content of conventional ice cream is in the range of about 19 to 34 wt. % , and they have a glycemic index of about 68, or more. A standard portion of conventional ice cream i.e.  $\frac{1}{2}$  cup or 65 grams, has a calorie content about 200 to 300. People suffering from diabetes or who have weight problems are advised by their medical doctors to avoid eating conventional ice cream because of the detrimental effect it may have on their health.

Prior art ice cream formulations in which natural cane sugar is replaced by artificial sweeteners generally suffer from after taste problems including bitter nuances. Further, they lack the clean taste, palatability, firmness, melting, and overrun properties of the subject invention comprising a unique mixture of ingredients including a synergistic combination of non-nutritive sweeteners.

A sugar-less ice cream formula is described in U.S. Patent 4,675,200. While the ice cream product in said patent contains no sucrose, dextrose, fructose, or glucose, the sweetening and texture forming agent comprises polyols. There are no such materials in the cane sugar-free sweetener of the subject invention. U.S. Patent

Replaced  
Article 3(y)

11/14/04

BEST AVAILABLE COPY

such materials in the cane sugar-free sweetener of the subject invention. U.S. Patent 4,626,441 substitutes Aspartame (phenylketone) for conventional sweeteners, either alone or in admixture with a sweetener and a bulking agent. The unobvious and synergistic mixture of sweeteners present in the subject invention are not found in said references, nor in any other ice cream. Further, the improved taste and spoonability, along with low total carbohydrates per serving, are unique with the ice-cream of the subject invention.

#### BRIEF SUMMARY OF THE INVENTION

The subject sweetener comprising a synergistic mixture of Lo Han Quo Extract and Sucralose Liquid is used to produce a unique low carbohydrate ice cream that is free from cane sugar. The Total Carbohydrate content of the ice cream is less than 16.1 wt. %, such as 13.6 wt. %, and the reduced calorie content is less than 1.8 calories per gram, such as 1.0 calorie per gram. The ice cream has an improved, clean, smooth taste and excellent spoonability. Softened ice cream product will become firm on being refrozen without the formation of ice crystals and without the loss of its excellent palatability and spoonability. A small synergistic amount of sweetener comprising about 0.014 to 0.018 wt % of Lo Han Kuo Extract and about 0.072 to 0.080 wt % of Sucralose Liquid is included in the ice cream. This amount converts to a weight ratio of Lo Han Kuo Extract / Sucralose Liquid in the range of about 0.19 to 0.23, such as about 0.21. Unexpectedly, a mixture of these two sweeteners in said weight ratio provides the ice cream product with an improved sweet, clean taste with no after taste. Small amounts of Glycerin (0.900 to 1.100 wt %) and CC305 (0.230 to 0.270 wt %) are included to emulsify and stabilize the product. Cream and skim milk are included to provide an overall butterfat content in the range of about 8.5 – 9.5 wt %. Further, there are no vegetable oils, natural cane sugar or sugar alcohol, which are ordinarily found in conventional ice cream, in the subject ice cream product.

In another embodiment, the same synergistic weight ratio of Lo Han Quo Extract / Sucralose Liquid as in the improved ice cream i.e. 0.21 is used as the sweetening agent in the manufacture of baked goods i.e. cake, candy, and beverages.

In another embodiment, a powdered sweetener is produced comprising Lo Han Quo Extract and Sucralose Powder. In still another embodiment, this powdered sweetener is attenuated by mixing it with polydextrose powder..

It is therefore an object of the present invention to provide an improved cane sugar-free sweetener comprising a synergistic mixture of Lo Han Kuo Extract and Sucralose Liquid or Powder for use in a low carbohydrate ice cream, and in baked goods, candy, and beverages..

Yet another object of the present invention is to provide a natural sugar-free ice cream, which in comparison with conventional ice creams has improved taste, overrun properties, melting rate, firmness, palatability and spoonability.

#### DETAILED DESCRIPTION OF THE INVENTION

An improved liquid sweetener which comprises in weight percent:

Lo Han Kuo Extract	16.3 – 18.4, say about 17.4.
Sucralose Liquid	83.7 - 81.6, say about 82.6

It was unexpectedly found that by the addition of a small amount of Lo Han Kuo Extract to Sucralose Liquid, the amount of Sucralose Liquid used to obtain the same sweetening effect of a tea spoon full of natural cane sugar may be considerably reduced. For example, the amount of Sucralose Liquid in the cane sugar free ice-cream mixture to be further described below, may be reduced from about 0.15 grams /100 grams of ice cream product to 0.075 grams /100 grams of ice-cream product, by adding about 0.016 grams of Lo Han Kuo Extract. This is

invention. Basis a serving size of one half cup or 62 grams, conventional ice cream containing natural sugars i.e. dextrose, levulose and glucose contain total carbohydrates in the range of about 19 to 38 wt %, a calorie content in the range of about 200 to 300, and a glycemic index of over 68. In comparison, the improved subject ice cream has a maximum total carbohydrate content of 13.6 wt %, a milk fat content of less than 1.2 wt %, and a maximum calorie content of 1.8 calorie / gram.

The glycemic index of the subject ice-cream is in the range of 31 to 34. The glycemic index refers to the amount of insulin released by a given carbohydrate in reference to a standard such as sucrose or white bread. By being low glycemic, less insulin is released and less glucose is converted to adipose tissue i.e. fat. The glycemic indices of Lo Han Kuo Extract and Sucralose Liquid artificial sweeteners are less than those of glucose and sucrose. Since the inventive product is low glycemic, its use may be considered by diabetics and those who are trying to lose weight.

Low Han Kuo Extract is a Mogroside sweetener made from *Momordica* fruit and is a product of China Natural Products Group Inc. Saint Louis Missouri. It is provided as a powdered extract containing at least 80 wt % of Mogroside. The remainder comprises water, ash, and fiber. It has a particle size of NLT 90% through 80 mesh. Sucralose Liquid comprises an aqueous solution of sucralose micronized powder in the amount of 24.5 to 25.6 wt %. The liquid concentrate is buffered to a Ph of 4.4 with sodium citrate / citric acid and preserved with potassium sorbate and sodium benzoate. Sucralose has the chemical formula of  $C_{12} H_{19} O_8 Cl_3$ . It is manufactured by " Mc Neil ". A comparatively small amount of the unique combination of sweeteners in the invention gives the ice cream a clean sweet taste. This is without the aftertaste that is commonly found with other sugar substitutes. The percentage and ratio of our combination of artificial sweeteners provides a synergistic sweetening without side effects.

Low microbial counts for the flavored ice-cream is shown in Table 1 below. Colony forming unit is designated by the term cfu, and standard plate count is represented by the term SPC.

Table 1  
Microbial Counts for Flavored Ice Cream

Flavor	Coliform cfu/ml	SPC cfu/ml	Yeast & Mold 3 day cfu/ml
--------	-----------------	------------	---------------------------

Vanilla	<1	110	<1
Chocolate	<1	70	<1
Almond	<1	70	<1
Coffee	<1	100	<1

In another embodiment, the same synergistic weight ratio of Lo Han Quo Extract / Sucralose Liquid i.e. about 0.21 is used to replace the sweetening agent in the manufacture of baked goods i.e. cake, and candy and to sweeten beverages i.e. coffee, tea, and carbonated water. In the manufacture of cane sugar-free baked goods i.e. cake and candy, the amount of Sucralose is thereby reduced while the taste is improved.

In still another embodiment, the Sucralose liquid in the aforesaid formula, is replaced by Sucralose micronized powder, while maintaining the same Lo Han Quo to Sucralose ratio. Sucralose Powder comprises about 98 to 100, say about 99.9 wt. % of Sucralose. In comparison, Sucralose liquid comprises about 24.5 to 25.6 wt. % of Sucralose. The particle size of micronized Sucralose powder is such that 90% is less than 12 microns. It is produced by Mc Neil. The low carbohydrate sweetener comprises in wt. %, about 45.6 – 45.8, or 45.7 of powdered Lo Han Quo Extract and about 54.4 – 54.2, or 54.3 of powdered Sucralose. The wt. ratio of Lo Han Quo Extract to Sucralose in the product is in the range of about 0.81 to 0.84

The improved low carbohydrate unflavored cane sugar-free ice-cream made with the aforesaid all powder sweetener of Lo Han Quo Extract and Sucralose Powder (99.9 wt.% Sucralose) is shown in Example 2 below in wt %.

**Example 2.**

Ingredients	Range	Best Mode
Lo Han Kuo Extract	0.014 – 0.018	0.016
Sucralose Powder	0.018 – 0.020	0.019
CC305	0.200 – 0.270	0.235
Glycerin	0.900 – 1.100	1.00
Polydextrose	9.059 – 10.110	9.582
Whey Protein Concentrate	1.550 – 1.620	1.585
Egg Yolk Solids	2.000 – 3.500	2.750
Non Fat Dry Milk Solids	2.800 – 3.20	3.00
Cream and Skim Milk	83.464 – 80.162	81.813

In still another embodiment, the aforesaid sweetener is attenuated by mixing it with polydextrose e.g. Sta-Lite III. The wt. ratio of Lo Han Quo Extract to Sucralose in the product is about 0.84. This low carbohydrate weakened sweetener may be used to sweeten beverages e.g. coffee, tea, and carbonated water, as well as in the manufacture of baked goods e.g. cake and cookies, and candy. It comprises in wt. %:

Ingredient	Range	Best Mode
Lo Han Quo Extract	2.74 - 1.83	2.29
Sucralose Powder.	3.26 - 2.17	2.71
Polydextrose	94.00 - 96.00.	95.00

(Continuation of Claim 14)

4) holding the homogenized ice cream mix from (3) at a temperature in the range of about 4.4 to 7.2 °C. at atmospheric pressure for about 12 to 48 hours; and,

5) cooling the ice cream mix from (4) to a temperature in the range of about -3.3 to -1.1 °C. while aerating and whipping, thereby producing ice-cream with a volume increase in the range of about 80-110 % greater than the volume of said basic ice cream mix from step (4).

15. The process of claim 14 provided with the step of mixing a flavor other than chocolate with the homogenized ice cream from step (3), or alternatively for chocolate flavor , mixing cocoa powder with the basic ice cream mix from step (1)

16. The Sucralose Liquid in claims I, 4, and 14 buffered to a pH of about 4.4 and containing a preservative.

17. A low carbohydrate unflavored basic ice cream composition comprising the following ingredients in wt. %;

Ingredients	Range	Best Mode
Lo Han Quo Extract	0.014 – 0.018	0.016
Sucralose Powder	0.018 – 0.020	0.019
CC 305	0.200 - 0.270	0.235
Glycerin	0.900 - 1.100	1.00
Polydextrose	9.059 – 10.110	9.582
Whey Protein Concentrate	1.550 – 1.620	1.585
Egg Yolk Solids	2.000 - 3.500	2.750
Non Fat Dry Milk Solids	2.800 – 3.200	3.000
Cream and Skim Milk	83.464 – 80.162	81.813

18. The ice cream composition of claim 17 containing flavoring in the amount of about 4.8 to 22.4 ml per liter of basic ice cream mix..
19. The ice cream composition of claim 17 wherein said Cream and Skim Milk provide a total butterfat content in the amount of 8.0 to 9.5 wt. %, said Cream is present in the amount of about 26.73 to 15.30 wt.%, and said Skim Milk is present in the amount of about 56.73 to 64.86 wt. %.
20. The ice cream composition of claim 17 having a Total Carbohydrate content of less than 16.1 wt. %, a calorie content of less than 1.8 calories per gram, and a Glycemic Index of less than 34.
21. A low carbohydrate powdered sweetener comprising the following ingredients in wt. %;

Ingredient	Range	Best Mode
Lo Han Kuo Extract	45.6 – 45.8	45.7
Sucralose Powder	54.4 – 54.2	54.3

wherein said Lo Han Quo Extract is provided as a powder comprising at least 80 wt.% of Mogracide made from Momodica fruit and said Sucralose Powder comprises 99.9 wt. % of Sucralose having the chemical formula of  $\text{C}_{12}\text{H}_{19}\text{O}_8\text{Cl}_3$

22. The sweetener of claim 21 for the sweetening of a product selected from the group consisting of ice cream, baked goods, candy, and beverages.
23. A cane sugar-free sweetener comprising the following in wt. %:

Ingredient	Range	Best Mode
Lo Han Quo Extract	2.74 - 1.83	2.29
Sucralose Powder	3.26 - 2.17	2.71
Polydextrose	94.00 – 96.00	95.00

## AMENDED CLAIMS

[received by the International Bureau on 29 June 2004 (29.06.04);  
original claims 17-24 amended; remaining claims unchanged (3 pages)]

*Replaced by page 3*

(Continuation of Claim 14)

- 4) holding the homogenized ice cream mix from (3) at a temperature in the range of about 4.4 to 7.2 °C. at atmospheric pressure for about 12 to 48 hours: and,
- 5) cooling the ice cream mix from (4) to a temperature in the range of about -3.3 to -1.1 °C. while aerating and whipping, thereby producing ice-cream with a volume increase in the range of about 80-110 % greater than the volume of said basic ice cream mix from step (4).
15. The process of claim 14 provided with the step of mixing a flavor other than chocolate with the homogenized ice cream from step (3), or alternatively for chocolate flavor, mixing cocoa powder with the basic ice cream mix from step (1)
16. The Sucralose Liquid in claims 1, 4, and 14 buffered to a pH of about 4.4 and containing a preservative.
17. A low carbohydrate unflavored basic ice cream composition comprising the following ingredients in wt. %;

Ingredients	Range	Best Mode
Lo Han Kuo Extract	0.014 – 0.018	0.016
Sucralose Powder	0.018 – 0.020	0.019
CC 305	0.200 - 0.270	0.235
Glycerin	0.900 - 1.100	1.00
Polydextrose	9.059 – 10.110	9.582
Whey Protein Concentrate	1.550 – 1.620	1.585
Egg Yolk Solids	2.000 - 3.500	2.750
Non Fat Dry Milk Solids	2.800 – 3.200	3.000
Cream and Skim Milk	83.464 – 80.162	81.813

18. The ice cream composition of claim 17 containing flavoring in the amount of about 4.8 to 22.4 ml per liter of basic ice cream mix..
19. The ice cream composition of claim 17 wherein said Cream and Skim Milk provide a total butterfat content in the amount of 8.0 to 9.5 wt. % , said Cream is present in the amount of about 26.73 to 15.30 wt.%, and said Skim Milk is present in the amount of about 56.73 to 64.86 wt. %.
20. The ice cream composition of claim 17 having a Total Carbohydrate content of less than 16.1 wt. %, a calorie content of less than 1.8 calories per gram, and a Glycemic Index of less than 34.
21. A low carbohydrate powdered sweetener comprising the following ingredients in wt. %;

Ingredient	Range	Best Mode
Lo Han Kuo Extract	45.6 – 45.8	45.7
Sucratose Powder	54.4 – 54.2	54.3

wherein said Lo Han Kuo Extract is provided as a powder comprising at least 80 wt.% of Mogracide made from Momodica fruit and said Sucratose Powder comprises 99.9 wt. % of Sucratose having the chemical formula of  $\text{C}_{12}\text{H}_{19}\text{O}_8\text{Cl}_2$

22. The sweetener of claim 21 for the sweetening of a product selected from the group consisting of ice cream, baked goods, candy , and beverages.
23. A cane sugar-free sweetener comprising the following in wt. %:

Ingredient	Range	Best Mode
Lo Han Kuo Extract	2.74 - 1.83	2.29
Sucratose Powder	3.26 - 2.17	2.71
Polydextrose	94.00 – 96.00	95.00

24. The sweetener of claim 23 wherein said Lo Han Kuo extract is a powder comprising at least 80 wt. % Mogroside made from Momordica fruit, and said Sucralose Powder comprises 99.9 wt. % of Sucralose micronized powder having the chemical formula  $C_{12}H_{19}O_8Cl_3$ .
25. The sweeteners of claim 23 for sweetening beverages.
26. The process of making low carbohydrate unflavored ice cream comprising:
  - 1) introducing into Skim Milk at a temperature in the range of about 31.1 to 48.9  $^{\circ}C$ . the following ingredients to produce a basic ice cream mix: Whey Protein Concentrate, Nonfat Dry Milk Solids, Egg Yolk Solids, Polydextrose, Glycerin, CC305, Lo Han Kuo Extract and Sucralose Powder, and Cream ,wherein said Lo Han Kuo Extract is a Mogroside sweetener made from Momordica fruit and is provided as powdered extract comprising at least 80 wt. % Mogroside and in the amount of about 0.014 to 0.018 wt %, and the Sucralose in said Sucralose Powder has the chemical formula of  $C_{12}H_{19}O_8Cl_3$  , and said Sucralose Powder is provided in the amount of about 0.072 to 0.080 wt %, and said CC305 stabilizer comprises a mixture of Carragenan, Guar Gum and Locust Bean Gum and is provided in the amount of about 0.230 to 0.270 wt %;
  - 2) pasteurizing the basic ice cream mix from (1) at a temperature of about 82.3 deg. C. for 60 – 80 seconds;
  - 3) homogenizing the pasteurized ice cream mix from (2) in two stages within 8-12 seconds, wherein the first stage takes place at a temperature in the range of about 46.1 to 51.7  $^{\circ}C$ . and a pressure in the range of about 33.3 to 36.8 kg per square cm and the second stage takes place at a temperature in the range of about 46.1 to 51.7  $^{\circ}C$ . and a pressure in the range of about 86.50 to 95.60 kg per square cm.;

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/36257

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : A23G 9/00; A23L 1/22, 3/3562  
 US CL : 426/658, 565, 567, 519, 524

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 U.S. : 426/658, 565, 567, 519, 524

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 USPATENTS, USPGPUBS, DERWENT, JAPO, EPO

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,682,766 A (BLUMENSTEIN-STAHL et al.) 27 January 2004.	1-29
A	US 6,432,464 A (ANDERSON et al.) 13 August 2002 (13.08.2002).	1-29
A	US 5,411,755 A (DOWNTON et al.) 02 May 1995 (02.05.1995).	1-29
A	US 5,433,965 A (FISCHER et al.) 18 July 1995 (18.07.1995).	1-29

<input type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input type="checkbox"/>	See patent family annex.
* Special categories of cited documents:			
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"B"	earlier application or patent published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 01 April 2004 (01.04.2004)	Date of mailing of the international search report 30 APR 2004
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer N. Bhat Telephone No. 571-272-0987 

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**